Background to the Precipitation Drought Status Products

The Sacramento River and San Joaquin River Drought Status products were created in collaboration with the California State Climatologist and the Climate Focal Points of the Sacramento NWS Forecast Office and CNRFC. The goal was to generate objective analysis for classifying droughts with an historical perspective. Since rainfall is perhaps the key parameter in assessing drought, we have developed two products which give objective rainfall analysis over the critical mountain regions which largely dictate the water supply conditions in California.

California water supply is ruled by two important discontinuities. First, the majority of the population of California (63%) lives in Southern California, the driest region of the State. As a result, the state relies heavily on the wet regions of northern California, in particular the Sacramento River basin, to meet water demands. The second discontinuity is seasonal. The majority (80-90%) of the rain and snow that falls each year is focused on 6 months of the year (November – April), while the greatest water demands are in the spring and summer months. Therefore, the state has made great efforts to store winter and spring runoff in reservoirs to meet year-long water supply demands. The majority of the State's water supply reservoirs are located in the Sacramento and San Joaquin River watersheds.

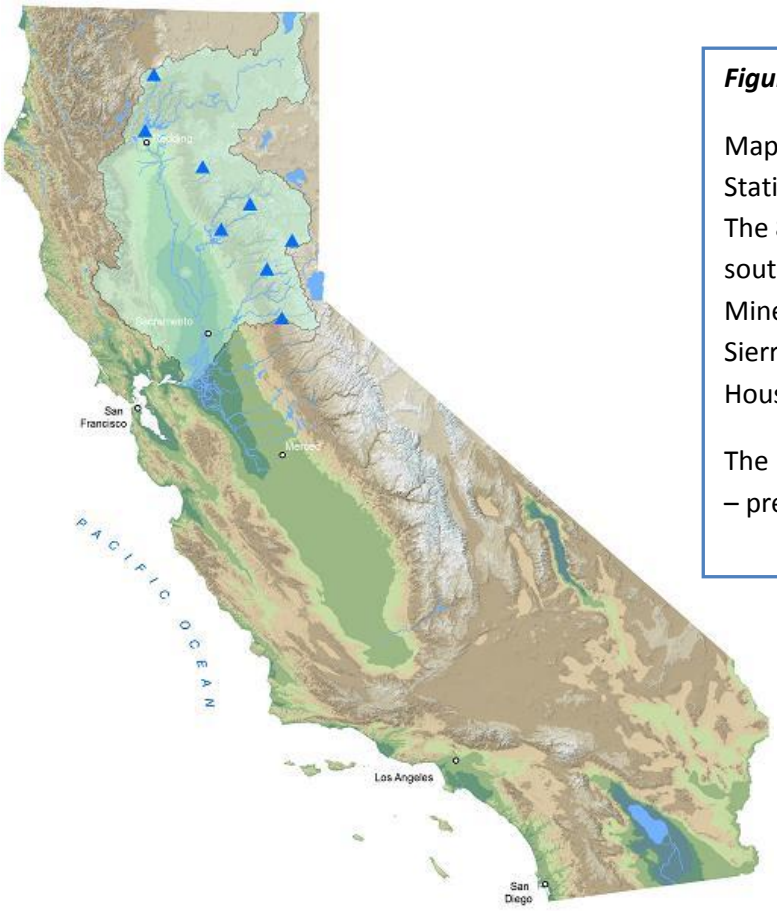

Figure 1

Map showing the locations of the 8 Station Index precipitation gages. The 8 gages are (listed from north to south): Mt Shasta City, Shasta Dam, Mineral, Quincy, Brush Creek, Sierraville, Blue Canyon and Pacific House.

The Period of Record is October 1920 – present.

As shown in Figure 1, the Sacramento 8 Station Index (8SI) encompasses long term climatological rain gages over the major tributaries to the Sacramento River.

To assess drought severity in comparison to previous droughts, an historical graph was developed which plots the October 1st percentile rank of the 8SI. The month of October was chosen as it marks the beginning of a water year. Weighting past rainfall was determined by looking at water supply indices. The California Department of Water Resources (DWR) annually assesses the State's water supply status based on a two year formula of runoff. For the Sacramento River watershed, this formula weights the current year runoff at 70% and the previous year's runoff at 30%. When we applied these same weights to the 8SI rainfall accumulations, the relative severity of the droughts fell out qualitatively as we expected. For example, the 1976-1977 drought was the worst, and the driest year ever (WY 1924) was also in the exceptional drought category. The 5 year 1988-1992 drought showed changing levels of severity (See Figure 2).

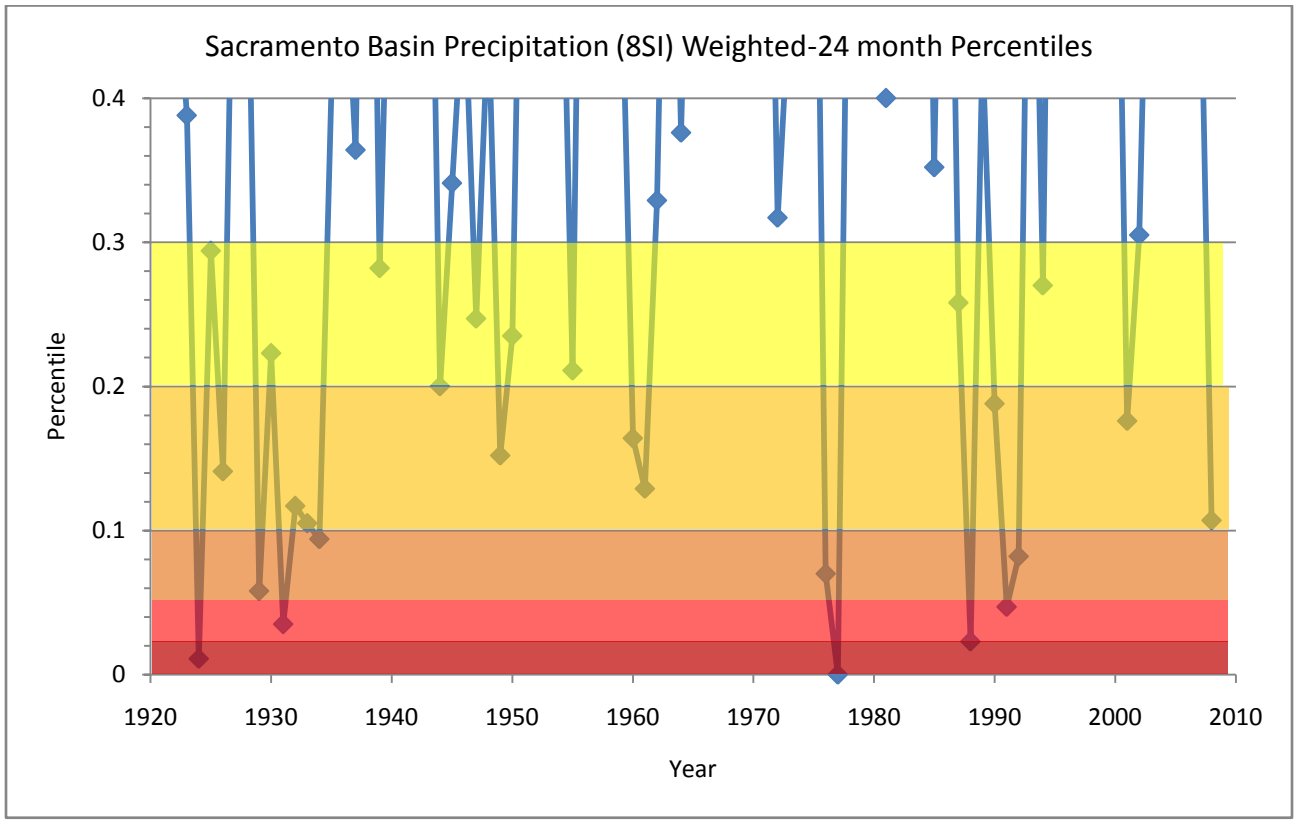

Figure 2

October 1st values of 8SI weighted 24-month accumulations. Only dry years are shown (below 0.40). Color scheme based on Drought Monitor (see http://www.drought.unl.edu/dm/drmon.gif

Percentile	Drought Monitor Category	
0.00 - 0.02	D4	Drought - Exceptional
0.02 - 0.05	D3	Drought - Extreme
0.05 - 0.10	D2	Drought - Severe
0.10 - 0.20	D1	Drought - Moderate
0.20 - 0.30	D0	Abnormally Dry
0.30 +		Normal

A similar approach was conducted in constructing the San Joaquin River Drought Status product which is based on a 5 Station Index compiled by the California DWR. The five stations were chosen based on their length of record and spatial distribution over the San Joaquin River watershed (see Figure 3).

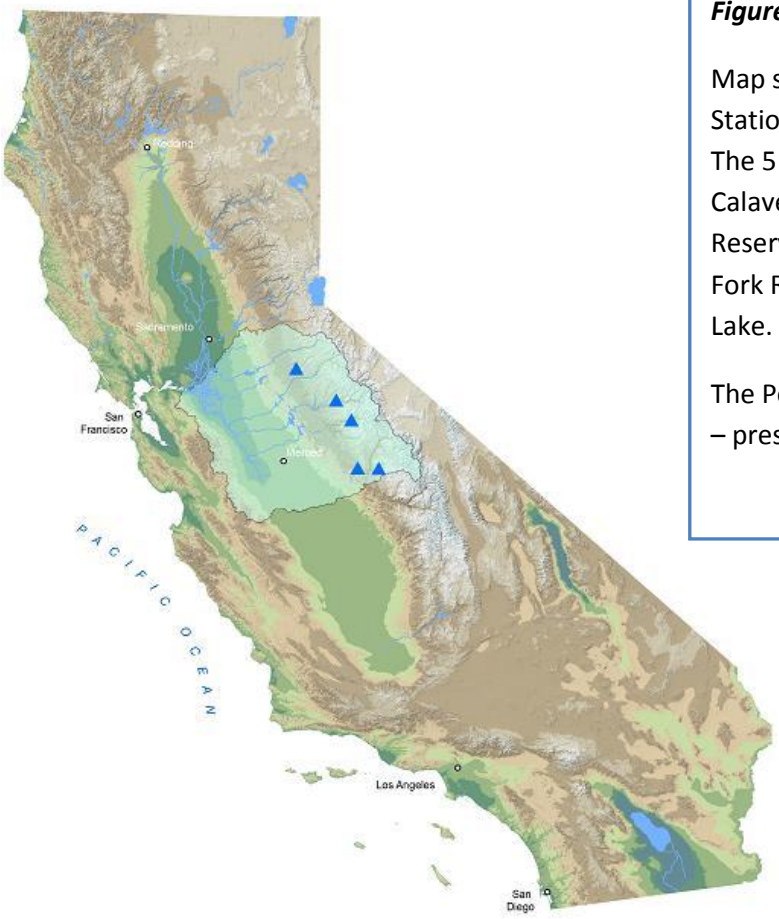

Figure 3

Map showing the locations of the 5 Station Index precipitation gages. The 5 gages are(from north to south): Calaveras Big Trees, Hetch Hetchy Reservoir, Yosemite Valley, North Fork Ranger Station, and Huntington Lake.

The Period of Record is October 1904 – present.

For the San Joaquin River watershed, the California DWR uses a runoff formula that weights the current year runoff at 80% and the previous year's runoff at 20%. This corresponds well with the different geologic nature of the San Joaquin which is less influenced by highly porous volcanic bedrock. The San Joaquin watershed is more dominated by granitic formations, whereas large portions of the Sacramento River have a large baseflow component due to volcanic bedrock,. As a result, drought severity is more highly influenced by the past 12 month's precipitation (See Figure 4).

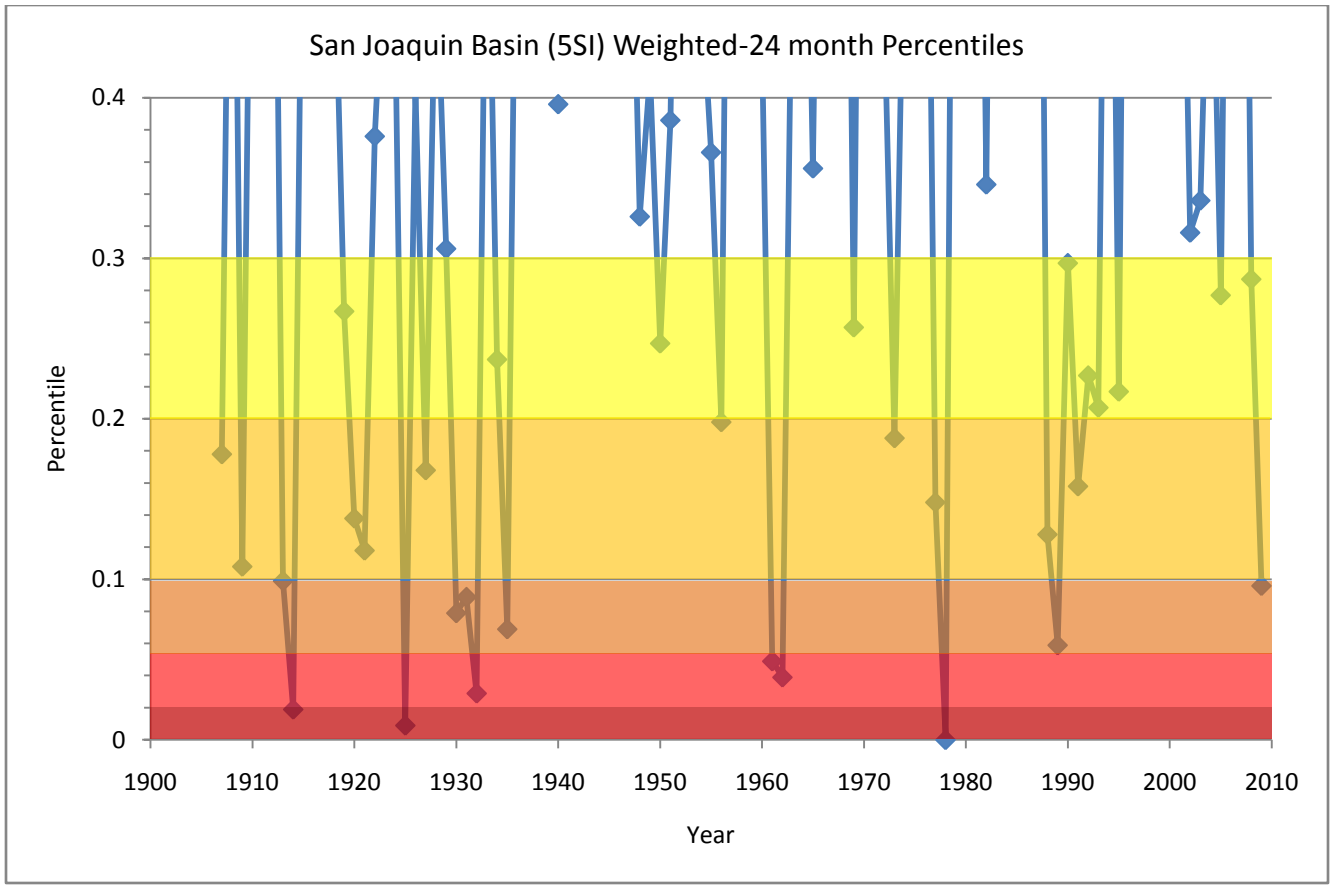

Figure 4

October 1st values of 5SI weighted 24-month accumulations. Only dry years are shown (below 0.40). Color scheme based on Drought Monitor (see http://www.drought.unl.edu/dm/drmon.gif

Percentile	Drought Monitor Category	
0.00 - 0.02	D4	Drought - Exceptional
0.02 - 0.05	D3	Drought - Extreme
0.05 - 0.10	D2	Drought - Severe
0.10 - 0.20	D1	Drought - Moderate
0.20 - 0.30	D0	Abnormally Dry
0.30 +		Normal

Product Details

The primary output of the Drought Status product is the six color percentiles listed for three categories or time scales: past 24 months-weighted, past 12 months and past 24 months (see Figure 5, below). Since all the data that serves as the basis for the percentiles is monthly data, the current drought status can be viewed by looking back at the start of the month, or looking forward to the end of the month. The time scales for the non-weighted percentiles is self-explanatory. For example, the "Past 12 months" value looks at the current 12 month accumulation of precipitation and then compares this value to the historical 12 month accumulations for the start of the current month. The weighted 24 month percentiles use the weights given by the DWR water supply indices as explained above. While these weights are used for runoff by the DWR, they have been applied here for precipitation.

Date: Monday, December 08, 2008

SAN JOAQUIN RIVER DROUGHT STATUS

Based on 5 Station Index (5SI) Percentiles

Current 5SI for WY2009:	5.90 inches
Median 5SI to date:	6.20 inches
Current WY Percentile:	0.465

5SI Percentiles	As of Dec 1	Projected for Dec 31
Past 24 months (weighted) *	0.238	0.265
Past 12 months	0.372	0.314
Past 24 months	0.102	0.060

Percentile	Drought Monitor Category	
0.00 - 0.02	D4	Drought - Exceptional
0.02 - 0.05	D3	Drought - Extreme
0.05 - 0.10	D2	Drought - Severe
0.10 - 0.20	D1	Drought - Moderate
0.20 - 0.30	D0	Abnormally Dry
0.30 +		Normal

Figure 5

Example of Drought Status Product from December 8, 2008.

The end of the month projections use both observed rainfall for the current month and a projected rainfall for the rest of the month. The projected rainfall looks at the current day of the month and the historical median rainfall for that month. The projected rainfall multiplies the median rainfall amount by the remaining fraction of the month. One day is subtracted from the current day, since the rainfall for the current day has not yet fallen. For example, if the Drought Status product is published on Nov 16th, the remaining fraction of the month is 0.50 ((16-1)/30). The 8SI median rainfall for November is 5.31 inches. If 3.00 inches has already fallen from Nov. 1 – 15th, then the projected rainfall for the end of the month would be 5.66 inches. This would then be added to the current year's October rainfall to get a total for the two month period (October- November). Percentiles are then calculated based on historical 12 or 24 month accumulations for November 30th.

The advantage of using projections is that one doesn't need to wait until the end of the month to see how the wetness or dryness of a certain month is affecting the overall drought status. If a series of wet storms improves the state's drought situation, this can be assessed as soon as the rainfall is reported. The disadvantage of using projections is that we assume median rainfall for the rest of the month. If rainfall turns out to be much greater or less than median, then the projections will not be very accurate. But during the spring and summer months, when the climate is much drier, the beginning of the month percentile and the end of month projected percentile will be very close (unless significant rainfall has occurred). In general, if it is early in the month, the beginning of the month percentiles will

be more representative of the drought status, but later in the month the projected percentiles will be better indicators.

Our opinion is that the weighted 24-month values best represent the drought status of these watersheds (when looking just at precipitation). However, the straight 12 and 24 month values were included to provide additional information about the length and severity of the dryness. For example, recent rainfall may greatly reduce the drought severity for the 12 month values, but still have little impact on the 24 month values.

Finally, we have also included the raw data for each of these indexes for the current water year and compare them to the median value for today's date. The percentile for the water year to date is also displayed. While later in the water year these values will be very close to the 12-month percentiles, during the early part of the water year they will give a good indication of how wet the year has been in comparison to the median. Median values and percentiles are used to remain consistent with the statistical approach of these products.

For any additional information on this product, please contact our webmaster at: Cnrfc.Webmaster@noaa.gov